

PB-217 085

SNAKE RIVER TRANSECT STUDY. STATION
NUMBER 153018, 29-30 JULY 1969

Gary L. Burns

Federal Water Pollution Control Administration
Portland, Oregon

April 1970

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

REGIONAL INFORMATION OFFICE

PB 217 085

File
Copy

WORKING

PAPER

No.

74

Apr. 1970



SNAKE RIVER TRANSECT STUDY



Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

FEDERAL WATER
POLLUTION CONTROL
ADMINISTRATION
NORTHWEST REGION
PORTLAND, OREGON

42

SNAKE RIVER TRANSECT STUDY

Station No. 153018

July 29 and 30, 1969

Prepared by

Gary L. Burns

Working Paper
No. 74

*Details of illustrations in
this document may be better
studied on microfiche.*

Technical Assistance and Investigations Branch
Office of Technical Programs
Federal Water Pollution Control Administration
Northwest Region
Portland, Oregon

April 1970

I-a'

A Working Paper presents results of
investigations which are to some extent
limited or incomplete. Therefore,
conclusions or recommendations--
expressed or implied--are tentative.

I-6

CONTENTS

	<u>Page</u>
INTRODUCTION	
Purpose	1
Objectives	1
Authority	3
Sampling Program	3
SUMMARY	5
Findings	5
Conclusions	9
Recommendations	12
STATION LOCATION AND DESCRIPTION	14
SAMPLING AND ANALYTICAL METHODS	
Sampling Methods and Schedule	15
Analytical Procedures	15
DISCUSSION	17
REFERENCES	25
APPENDIX	26

FIGURES

<u>Figure No.</u>		<u>Page No.</u>
1	General Location Map	2
2	Temperature and Dissolved Oxygen Diurnal Values (Cross-Section Average)	6
3	Turbidity and Percent Saturation Diurnal Values (Cross-Section Average)	7
4	pH and Conductivity Diurnal Values (Cross-Section Average)	8
5	Total and Fecal Coliform Diurnal Values	10
6	Temperature and Dissolved Oxygen Diurnal Values (by station)	18
7	Turbidity and Percent Saturation Diurnal Values (by station)	19
8	Total and Fecal Coliform Diurnal Values (by station)	20
9	pH and Conductivity Diurnal Values (by station)	21

TABLES

<u>Table No.</u>		<u>Page No.</u>
1	Flow Measurements Snake River Near Clarkston, Wn.	11
2	Data from Upstream Survey	24

INTRODUCTION

Purpose

The Federal Water Pollution Control Administration (FWPCA), Pollution Surveillance Branch, maintains a system of water quality sampling stations on interstate waters in the Northwest Region. Throughout the year the water samples are collected at these stations and analyzed, and the data are used to evaluate water quality. Knowledge of conditions peculiar to these stations is valuable in the evaluation of the data obtained. This study documents conditions at Station No. 153018 located on the Snake River seven miles downstream from the Lewiston-Clarkston bridge (Fig. 1). Diurnal and spatial variances occurring at the station were observed during a 24-hour period.

On February 25 through 29, 1969, a similar study was conducted at the station which was then located two miles upstream from the present Station No. 153018. This survey showed that an incomplete mixing condition is present at that location. As a result, the station was relocated at the present site to allow more mixing time and to take advantage of more homogenous sampling conditions.

Objectives

The objectives of the study were to answer the following questions:

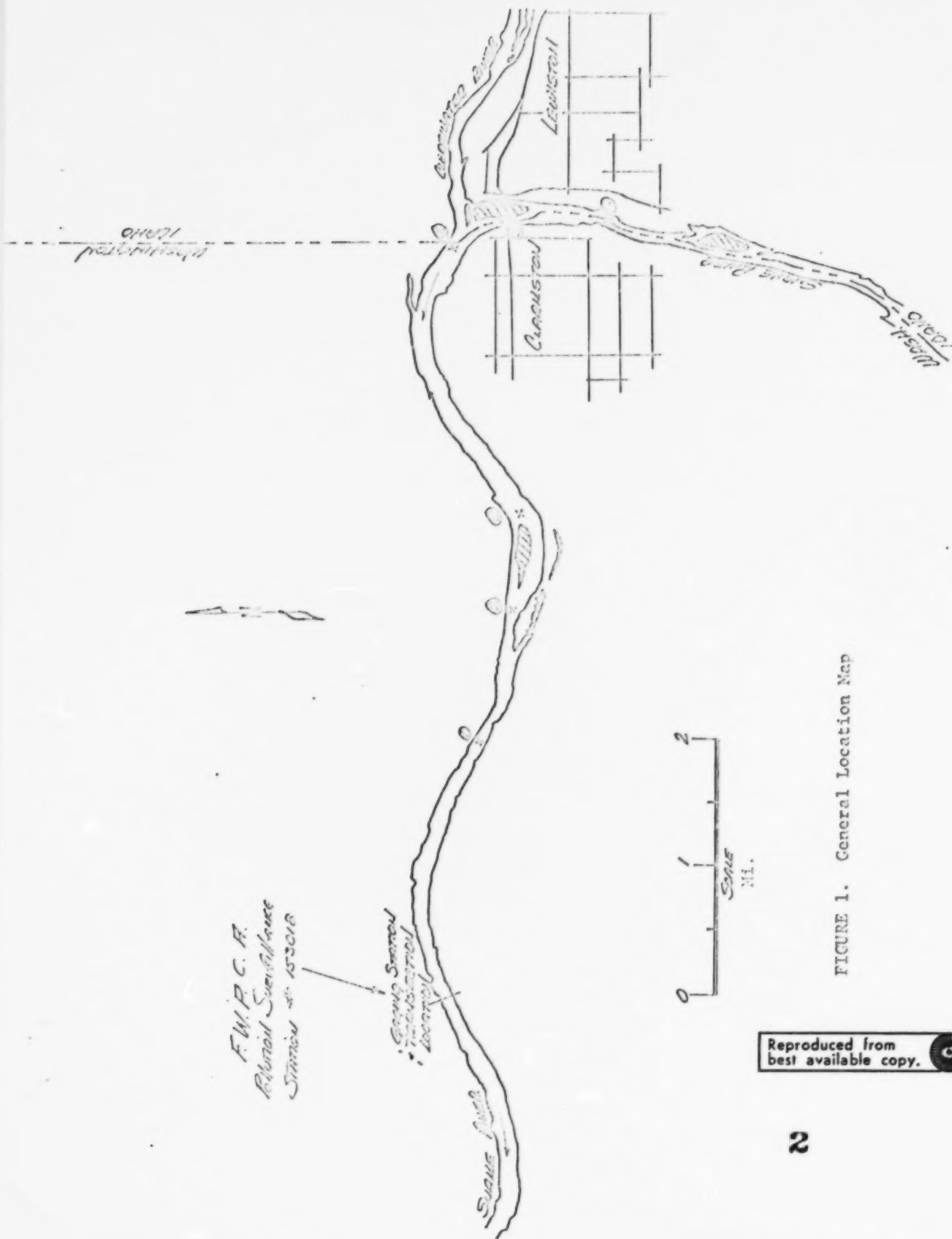


FIGURE 1. General Location Map

Reproduced from
best available copy.



1. Does a uniform cross-section pattern exist at the sampling site?
2. What are the diurnal changes occurring in water quality at the station?
3. What are the influencing factors on water quality at this location?

Authority

Authorization for this study was from the Federal Water Pollution Control Act (33 U.S.C. et seq.) as amended. The study was performed by the Technical Assistance and Investigations Branch of the Office of Technical Programs as requested by the Pollution Surveillance Branch.

Sampling Program

1. Six water samples were collected every two hours for a 24-hour period. The initial sample collection was at 1200 hours (noon) on July 29, 1969, with the final samples taken at 1200 hours on July 30, 1969. Samples were also taken at six sites extending upstream from Station No. 153018 to above the confluence of the Clearwater River (Fig. 1).
2. Pre-survey soundings confirmed that the cross-section at Station No. 153018 had a uniform depth of 17.0 feet. Three equally-spaced sampling points were selected across the river. The sampling

points were located by means of airplane markers on a gauging car wire extended across the site. Samples were taken at 5-foot and 15-foot depths at each of these sampling points.

3. The following analyses were performed on the samples: pH, specific conductivity, dissolved oxygen, total alkalinity, total coliform, fecal coliform, and turbidity.

Findings

1. The river had a uniform depth of 17 feet at the transection location.

2. The only discrepancy in cross-section station parameter values occurred in bacteriological concentrations and turbidity measurements.

3. The diurnal temperatures ranged from a high at 1200 hours (noon) of 23.5°C ^{1/} to a low of 19.1°C at 0600 hours (Fig. 2).

4. The percent dissolved oxygen saturation values displayed a high of 115 percent at 1800 hours, decreasing to a low of 86 percent at 0600 hours, and then rising again (Fig. 3).

5. The dissolved oxygen concentration pattern indicated a high of 10.0 milligrams per liter (mg/l) at 1800 hours, then dropped to a low of 7.8 mg/l at 0600 hours (Fig. 2).

6. The pH ranged from 7.5 to 8.5. Two maximum peaks occurred, the first at 1600 hours with an 8.4 value, and the second at 1800 hours with a value of 8.5. The minimum was 7.5 at 1200 hours (Fig. 4).

7. Specific conductivity values ranged from a maximum of 190 micromhos per centimeter ($\mu\text{mho/cm}$) at 1400 hours, to a low of 158 $\mu\text{mho/cm}$ at 0600 hours (Fig. 4).

8. The bacteriological concentration count was the only parameter that did not display the general pattern of higher values occur-

^{1/} All parameter values quoted in the Findings are bi-hourly averages for the six cross-section samples.

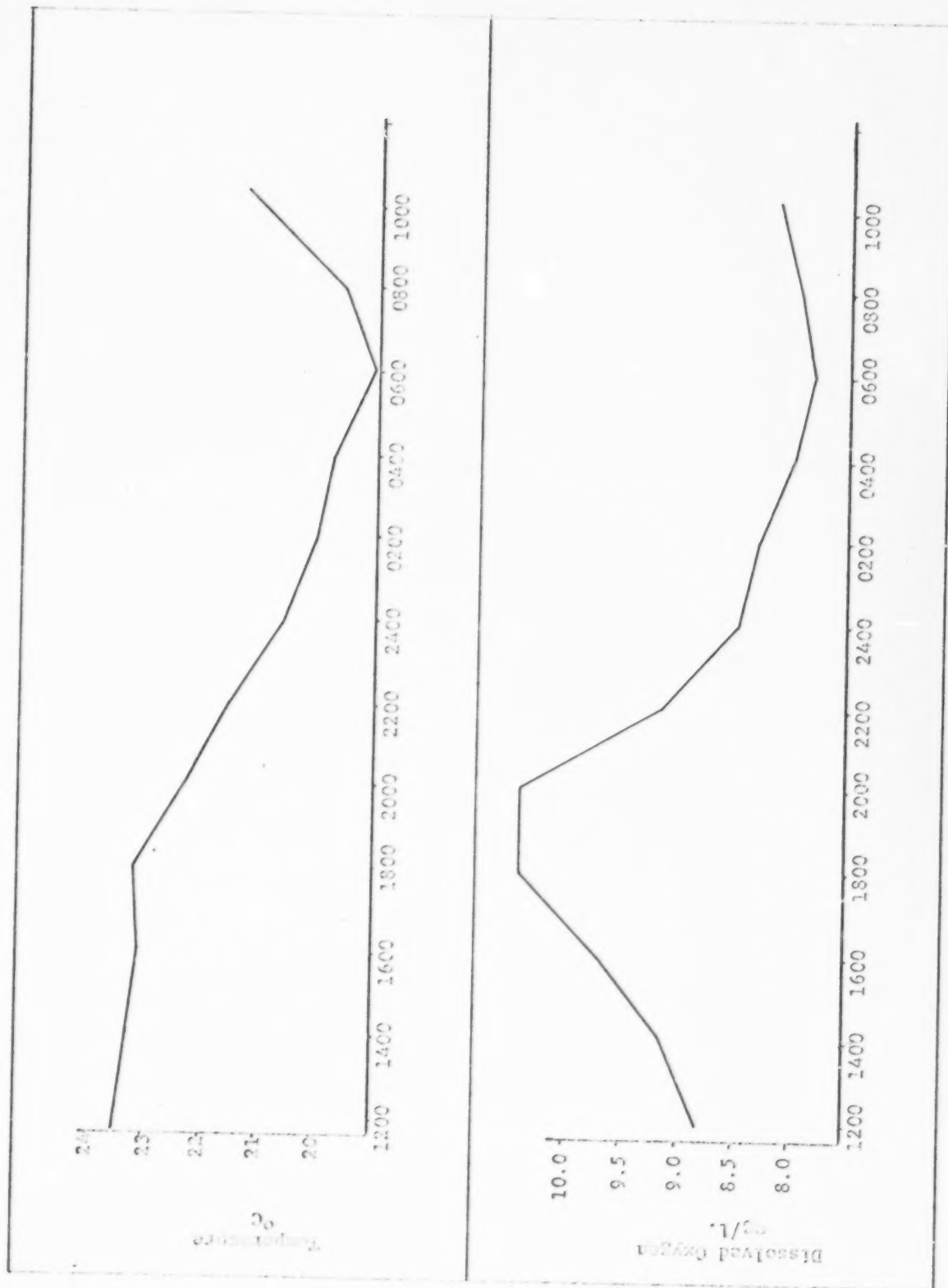


FIGURE 2. Temperature and Dissolved Oxygen Diurnal Values (Cross-Section Average)

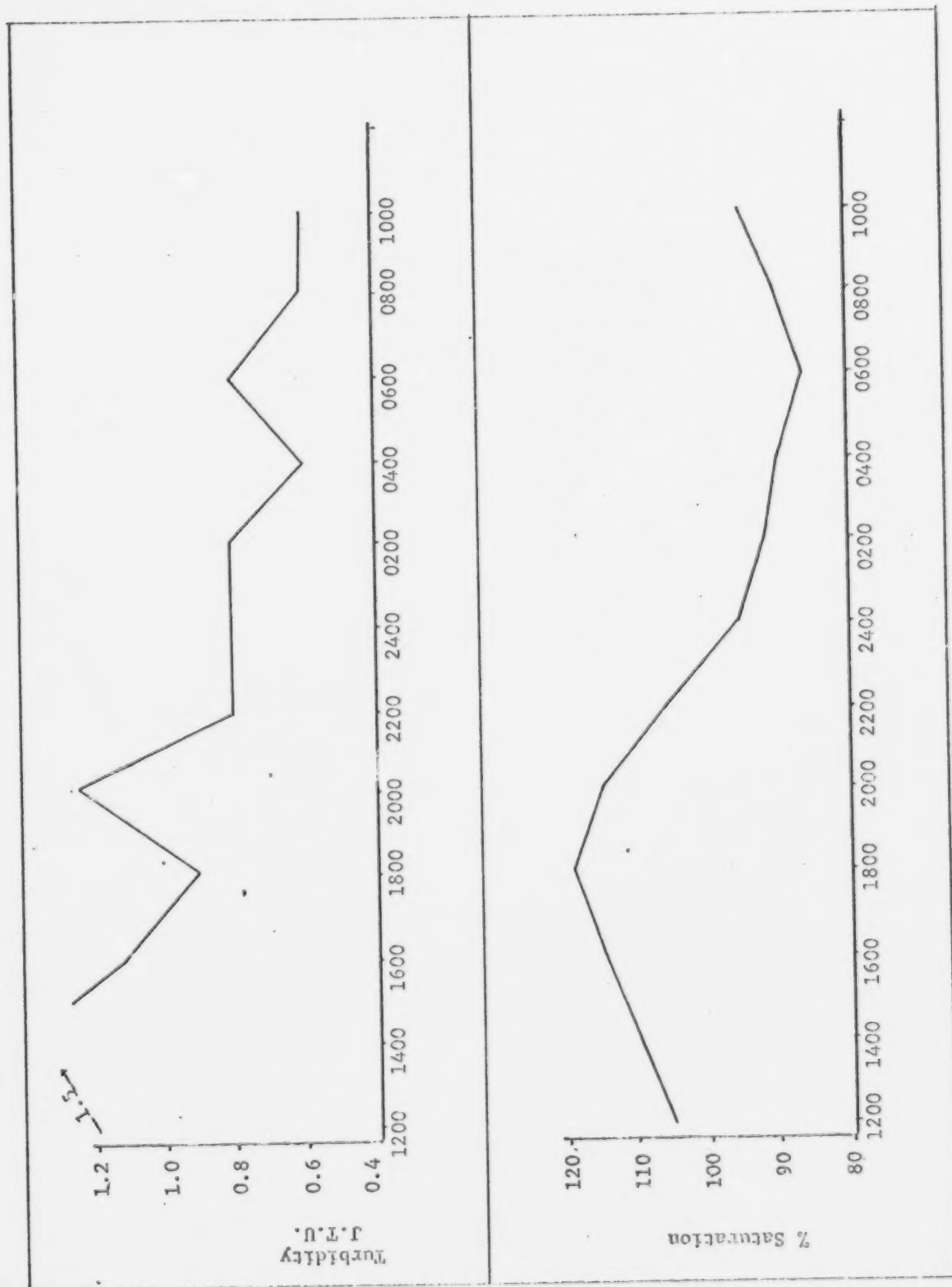


FIGURE 3. Turbidity and Percent Saturation Diurnal Values (Cross-Section Average)



FIGURE 4. pH and Conductivity Diurnal Values (Cross-Section Average)

ring from 1200 hours to 2400 hours, with the lower values present during late night and early morning (Fig. 5).

9. The total and fecal coliform densities displayed two maximum peaks—one of 3300 total coliforms per 100 milliliters (TC/100 ml), and 160 fecal coliforms per 100 milliliters (FC/100 ml) at 2400 hours, and another at 0600 hours with values of 3880 TC/100 ml and 196 FC/100 ml (Fig. 5). The increases were both 100 times the low values of 333 TC/100 ml and 1 FC/100 ml recorded at 1600 hours.

10. The flow measurements for the study period show an average hourly flow of 22,500 cubic feet per second (cfs). The data, as obtained from the U. S. Geological Survey, are shown in Table 1.

Conclusions

1. The sampling station is located far enough downstream from pollution sources to allow sufficient mixing to produce optimum sampling conditions.

2. The differences in the diurnal values for coliforms and turbidity among the three cross-section sampling locations indicate incomplete mixing of solids. Data from previous surveys indicate this condition exists for an undetermined distance downstream from the sampling station.

3. With the exception of the bacteriological counts, the diurnal parameter patterns displayed higher values between 1200 hours and 2000 hours. The minimum recorded values appeared between the hours of 2400 and 1000.

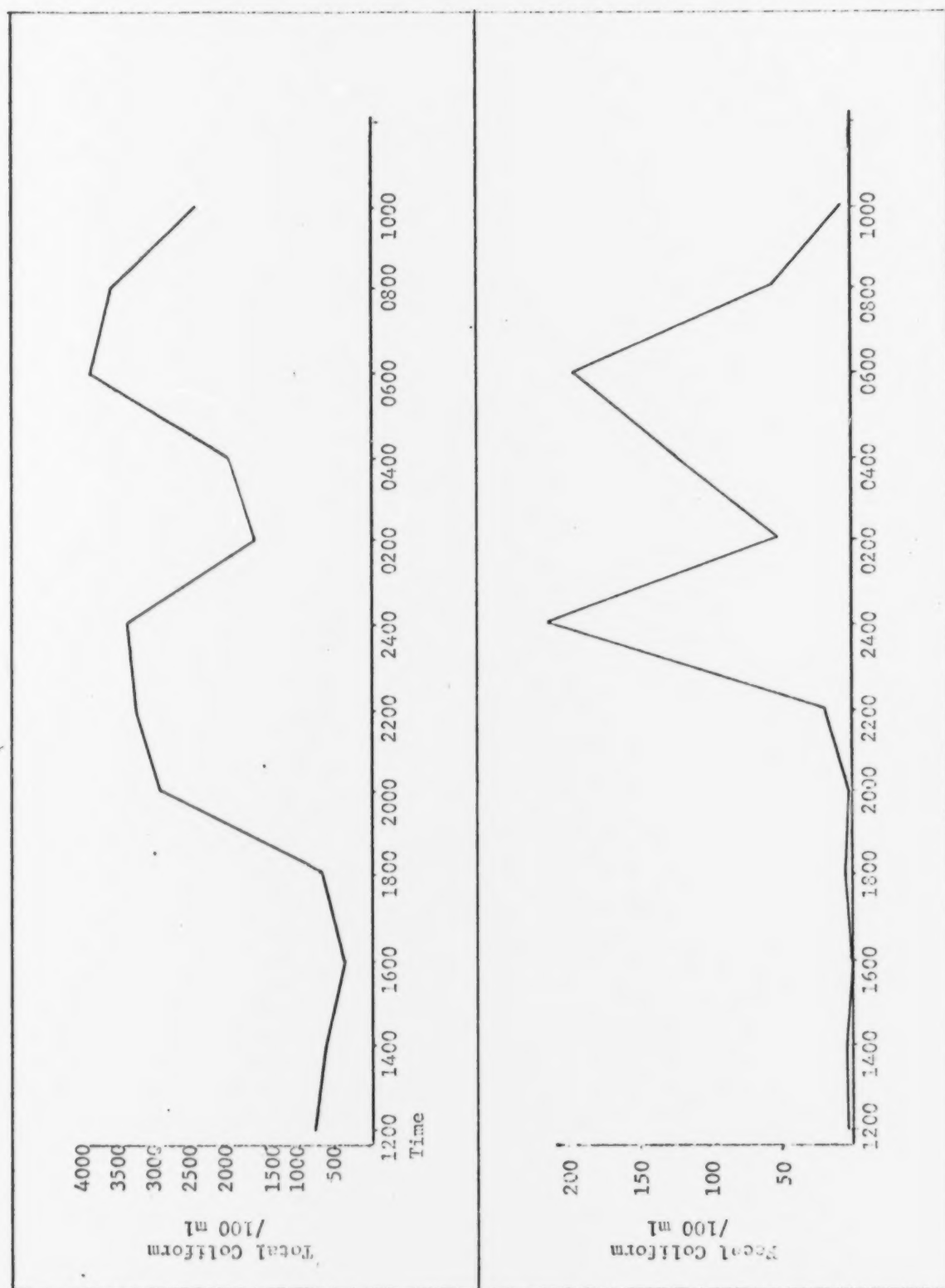


FIGURE 5. Total and Fecal Coliform Diurnal Values (Cross-Section Average)

TABLE 1
FLOW MEASUREMENTS
SNAKE RIVER NEAR CLARKSTON, WASHINGTON

Date	Time	Gage Height	Discharge (cfs)	
July 29, 1969	1200	11.52	22,600	↑ AVERAGE 22,500 ↓
	1400	11.51	22,500	
	1600	11.52	22,600	
	1800	11.52	22,600	
	2000	11.50	22,500	
	2200	11.48	22,400	
	2400	11.49	22,500	
July 30, 1969	0200	11.50	22,500	
	0400	11.50	22,500	
	0600	11.50	22,500	
	0800	11.49	22,500	
	1000	11.48	22,400	

4. The upstream factors that would have an influence on water quality are:

a. Potlatch Forest, Inc., manufacturers of lumber, pulp, paper, and fuel products, discharges effluent into the Snake River a quarter of a mile above the confluence of the Clearwater River.

b. The Lewiston city sewage treatment plant discharges effluent into the Clearwater River 0.8 miles above its confluence with the Snake River.

c. The Clarkston city sewage plant is located on the Snake River, one mile below the confluence of the Clearwater River.

d. Asotin sewage treatment plant discharges into Asotin Creek, just upstream from the mouth.

e. Seabrook Farms Co. and Smith Frozen Foods, both processors of peas, are located in Lewiston and both have discharges into the Snake River.

f. Meats, Inc., and Bristol Packing Co., located in Clarkston, discharge floor drainage and kill blood directly into the Snake River.

g. A few feedlots are located adjacent to the rivers above and below the cities of Lewiston-Clarkston.

Recommendations

1. Sampling Station No. 153018 should be maintained as a permanent water quality monitoring station.

2. The samples should be collected on the south side of the transect station to provide better access and decrease travel time.

3. To maintain consistency, samples should be collected between mid-morning and mid-afternoon.

4. If feasible, during the low-flow periods, two samples (one on the north side and one on the south side) should be collected to confirm river mixing conditions.

5. An extensive study should be conducted, concentrating on the significance of bacteriological contributors located upstream from the sampling site.

STATION LOCATION AND DESCRIPTION

The station is located at river mile 132.9 of the Snake River, seven miles below the towns of Lewiston, Idaho and Clarkston, Washington. At this point, the Snake River turns westward after flowing through Hells Canyon (Fig. 1).

The specific location is: lat $46^{\circ}25'30''$, long $117^{\circ}10'30''$.

SAMPLING AND ANALYTICAL METHODS

Sampling Methods and Schedule

Water samples were collected every two hours during the 24-hour period. Collection was made at three pre-determined cross-section points, with two vertical profile samples taken at each of the three points. The samples were obtained using a Kemmerer^{1/} sampler. A single "haul" provided enough water to fill containers for chemical (dissolved oxygen, conductivity, pH, alkalinity, and turbidity) and bacteriological (total and fecal coliform) analyses.

Turbidity samples were shipped to the Federal Water Pollution Control Administration Laboratory in Portland, Oregon for analysis.

Dissolved oxygen samples were chemically stabilized at the time of collection for titration upon return to the field laboratory.

With the exception of turbidity measurements, all of the analyses were performed in a 17-foot enclosed laboratory trailer stationed near the sampling point.

Analytical Procedures

The following laboratory methods were used for analysis:

pH was determined with a Beckman Zeromatic Model pH meter.

Specific conductivity analyses were performed with an Industrial Instruments Model RC-16-B2 conductivity bridge.

Dissolved oxygen samples were titrated for quantity, using the

^{1/}The mention of brand names is for identification only and constitutes no endorsement by the United States Department of Interior, Federal Water Pollution Control Administration.

Alsterberg (Azide) modification of the Winkler Method as found in "Standard Methods." (1).

Alkalinity was determined by titration with a Hach Model DL-ER portable laboratory.

Turbidity was measured at the Portland Laboratory with a Hach Model 1860-A Turbidimeter.

Fecal coliform determinations were conducted using the membrane filter method according to the procedure described by Geldreich (2). In studies by Geldreich (3) this method was confirmed as comparable to the most probable number method for fecal coliform as described in "Standard Methods" (1).

Total coliform densities were measured by the membrane filter method technique in "Standard Methods" (1).

All the bacteriological samples analyzed were incubated and counted in the field.

DISCUSSION

The cross-section parameter values for the sampling points are given in Figures 6 through 9. With the exception of bacteriological and turbidity values, the transect discrepancy is minimal. The cross-section pattern shows no location preference as to high or low values.

The cross-section averages for total and fecal coliform concentrations (Fig. 8) show the increasing values beginning at 2000 hours, then dropping again to a low at 1000 hours the next day. The patterns also indicate both values decreasing at 0200 hours. This pattern could be attributed to treatment plant operations upstream, with the daytime loads being detained in the plant system and flushed out with the evening high flows. The times of high concentrations (considering flow time), also coincide with clean-up operations from upstream meat and industrial processors.

The conductivity, pH, temperature, dissolved oxygen and percent saturation values all displayed an average (cross-section) diurnal pattern of higher values occurring between 0800 hours and 2200 hours (Fig. 6, 7 and 9). This pattern reflects the daytime schedule of industrial activities and the processes of photosynthetic organisms present in the river.

Examination of the data reveals that at times during the study total coliforms, dissolved oxygen, and temperature did not meet the Washington State Water Quality Standards⁽⁴⁾ which state:

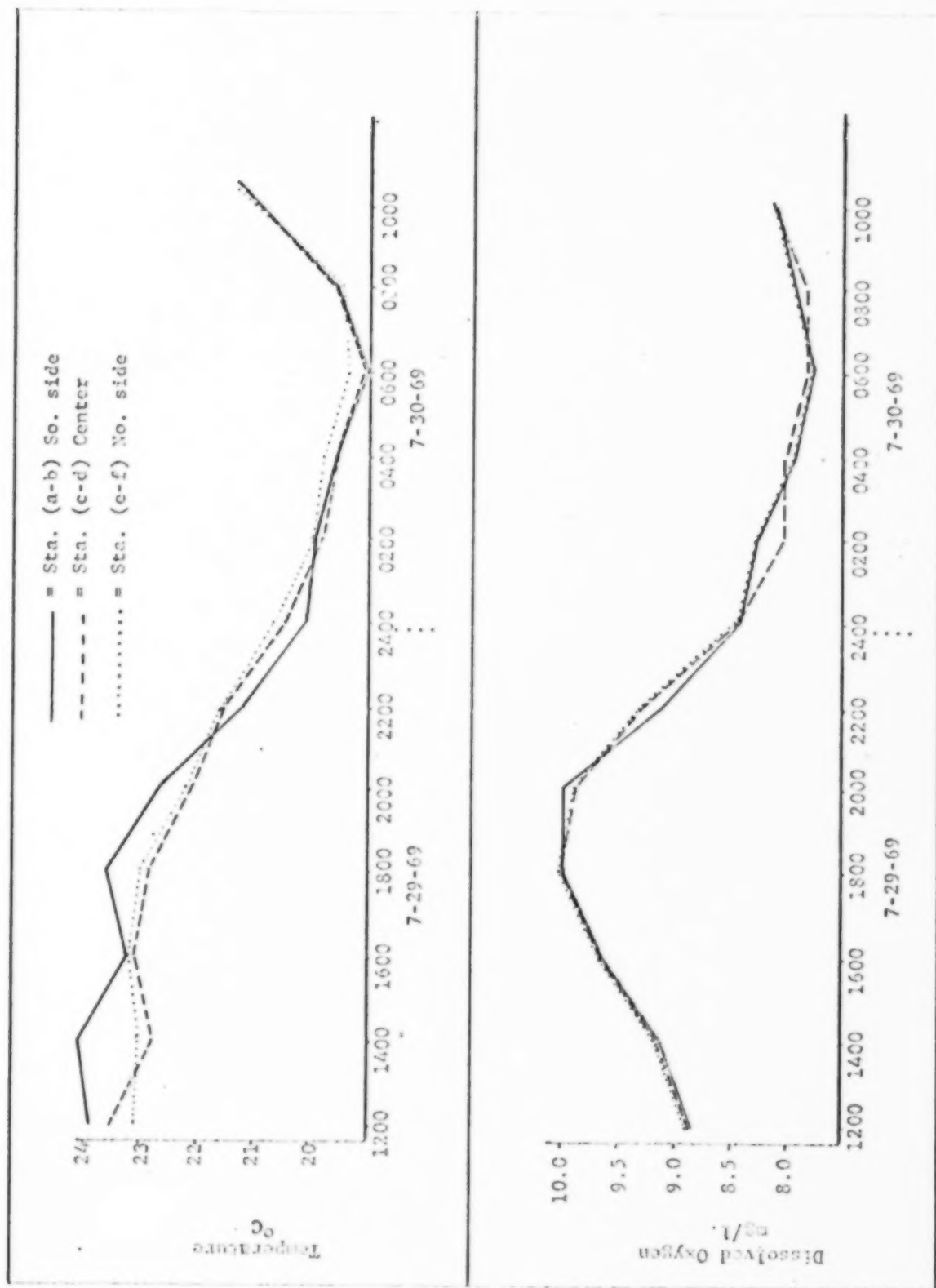


FIGURE 6. Temperature and Dissolved Oxygen Diurnal Values (by station)

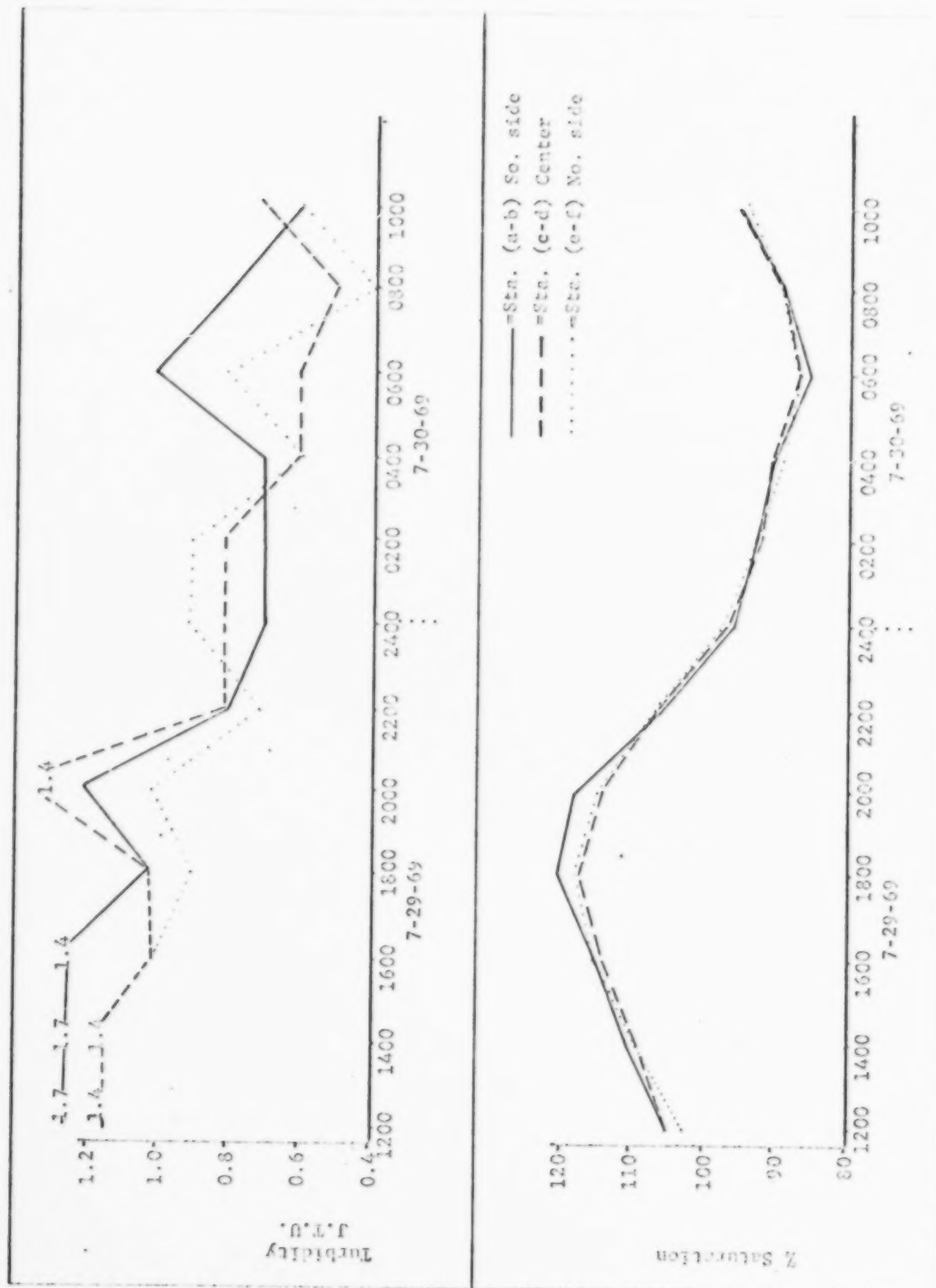


FIGURE 7. Turbidity and Percent Saturation Diurnal Values (by station)

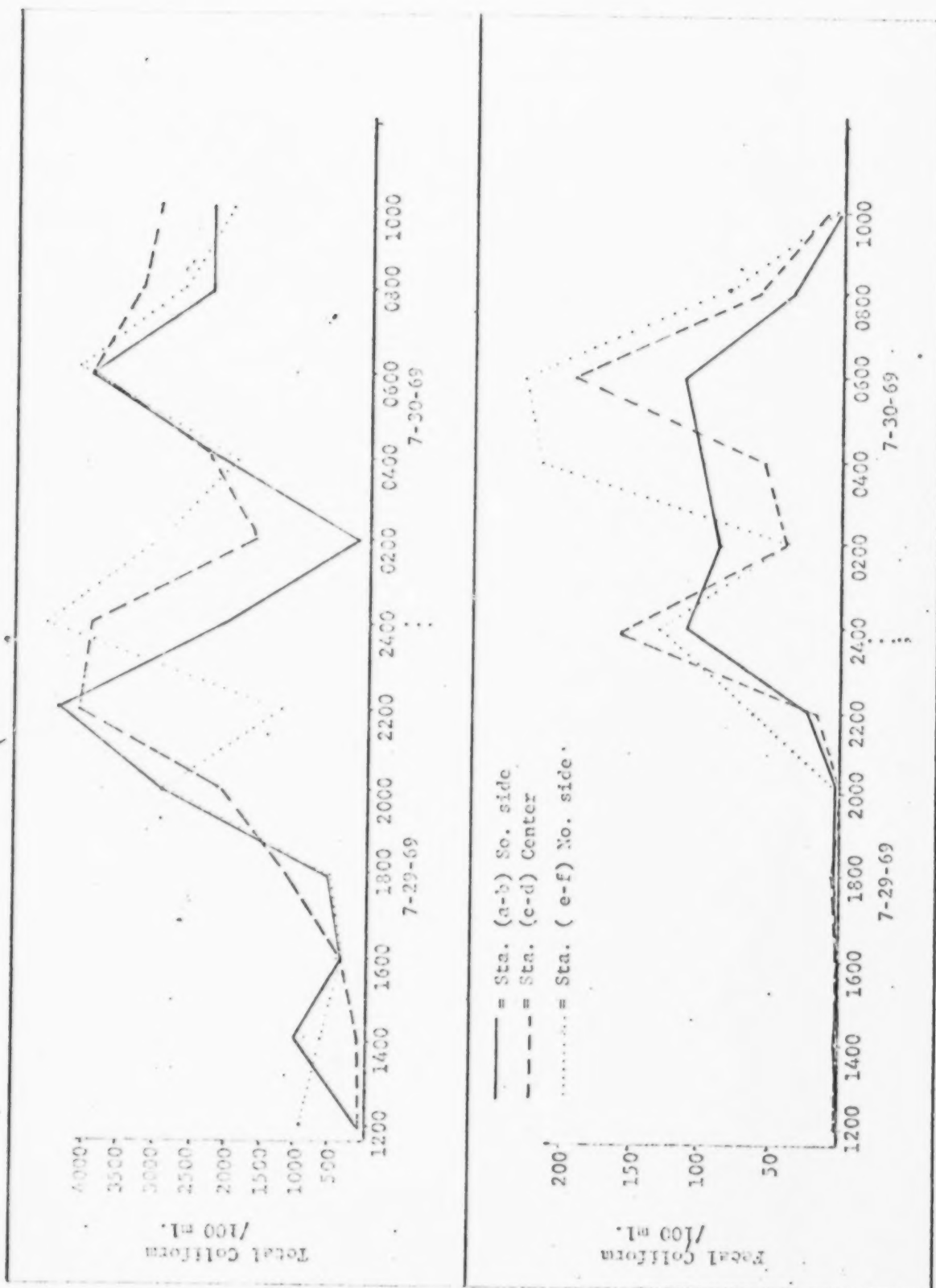


FIGURE 8. Total and Fecal Coliform Diurnal Values (by station)

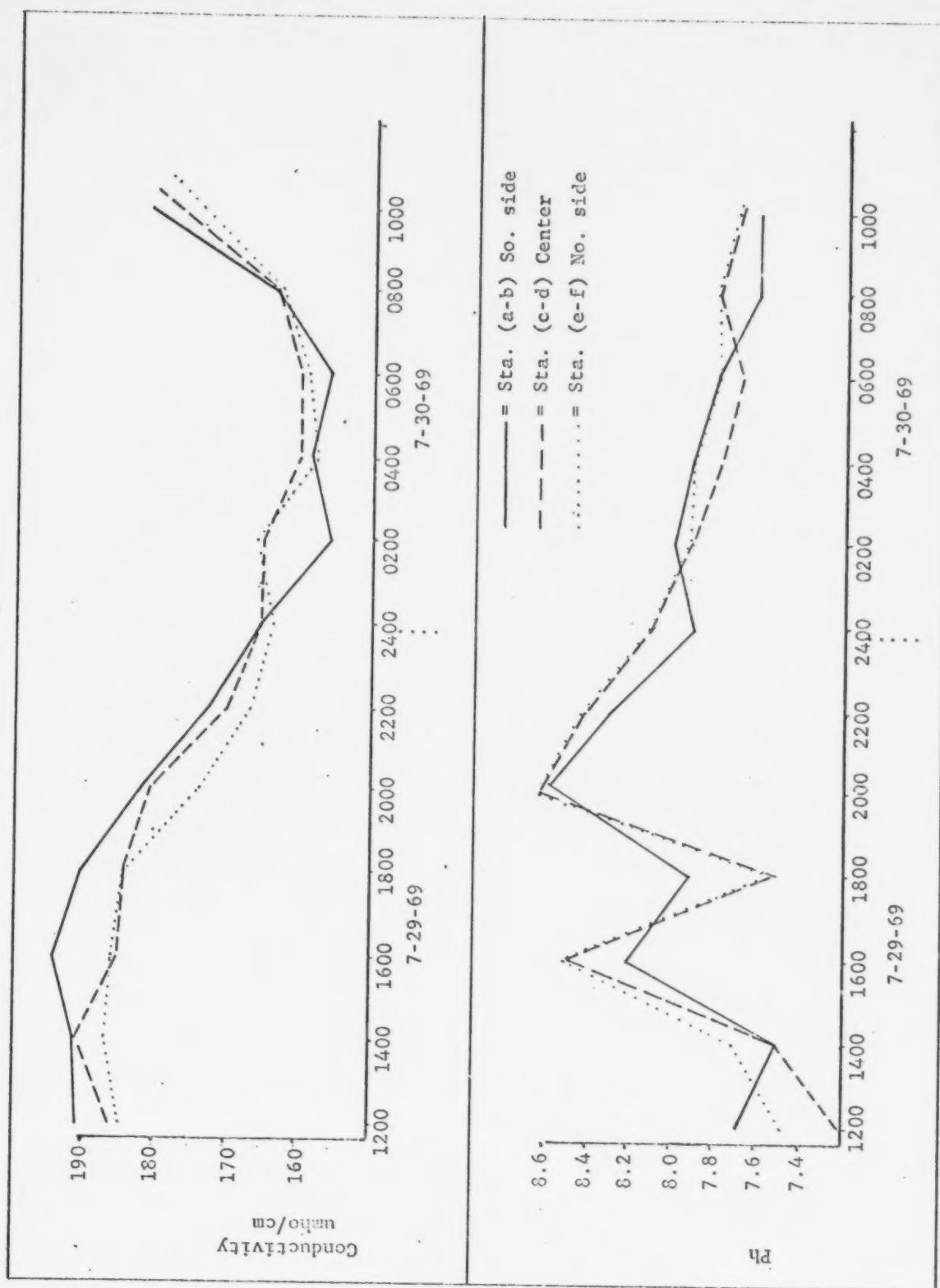


FIGURE 9. pH and Conductivity Diurnal Values (by station)

Total coliform organisms shall not exceed median values of 240...with less than 20% of samples exceeding 1,000 when associated with any fecal source....

Dissolved oxygen shall exceed 8.0 mg/l....

Temperature. No measurable increases shall be permitted... which result in water temperatures exceeding 68° F...

The dissolved oxygen values were below the Washington State Standards for only one sampling period. The total coliform concentrations were in excess of the Washington State Standards during the entire study. Temperature was in violation of the Standards during 75 percent of the study period.

Municipal waste sources in the lower Snake basin are concentrated in the Lewiston service area, where primary is the prevailing level of waste treatment. A total organic waste load equivalent to that from a population of 34,900 is discharged from the service area. The city of Lewiston accounts for about 30,000 population equivalents (PE). The Idaho Water Quality Standards (5) call for secondary waste treatment at Lewiston by June 30, 1970. In addition, the Washington Water Quality Standards (4) require installation of secondary treatment, disinfection facilities, and proper outfalls at Clarkston and Asotin by March 31, 1970.

The most significant source of waste in the area is the Potlatch Forest Industries plant located in Lewiston. A complex of manufacturing operations, the plant includes a large lumber mill, a plywood plant, wood fabricating facilities, and an integrated pulp, paper, and paperboard mill. The pulp and paper plant provides no treatment

of wastes, and available information on plant operations indicates that it has a waste-to-product ratio well above the norm for modern sulfate pulping plants. A total organic load of about 432,000 PE is discharged to the Snake River. The Idaho Water Quality Standards⁽⁵⁾ require that Potlatch Industries provide primary treatment.

Seabrook farms, Inc., a pea and potato processing plant at Lewiston, also discharges without waste treatment. An organic load of about 50,000 PE is discharged into the Clearwater River. The Idaho State Water Quality Standards⁽⁵⁾ require that primary treatment be installed and connected to the city collection system by June 30, 1970.

Two meat packing plants in Clarkston, Washington have inadequate treatment. Bristol Packing Co. and Meats, Inc., discharge a total organic load of about 5,300 PE to the Snake River. The Washington State Standards⁽⁴⁾ call for primary treatment at these plants by March 31, 1970.

Agricultural animal waste discharges in the Lower Snake are a significant source of coliform bacteria and a source of some of the biochemical oxygen demand. The estimated organic waste potential of the animal population is equivalent to that from a population of 3.2 million people. An estimated 95 percent of the wastes generated are reduced by deposit to the land and natural decomposition, so that about 160,000 PE eventually reach waterways. Grazing and feeding farm animals are considered to be a major waste source, but their

impact on water quality is difficult to determine. Stream bank feedlots and dairies are situated at a number of points, providing an unrestrained source of serious bacterial contamination. Less concentrated but significant influences are pasture and grazing areas along the water courses and drainage ditches. In many areas the stream banks are not fenced, allowing the animals unrestricted access to the water.

The data obtained from the upstream survey is shown in Table 2.

The appended data contains all the field data obtained on the survey.

TABLE 2
DATA FROM UPSTREAM SURVEY

Station No.*	Conductivity	pH	D.O.	Turbidity
	µmho		mg/l	JTU
1	217	8.5	9.6	0.6
2	244	8.7	9.6	0.6
3	190	7.6	9.2	0.3
4	255	8.5	10.4	0.5
5	250	8.4	10.6	0.7
6	249	8.8	10.4	0.7

* Station locations shown in Figure 1.

REFERENCES

- (1) American Public Health Assoc., Inc. Standard Methods the examination of water and wastewater, 12th ed. 1962.
- (2) Geldreich, Edwin E., et al. Fecal coliform organisms medium for membrane filter technique. Journal American Water Works Assoc. 57:2, 208-214, 1965.
- (3) Geldreich, Edwin E. Sanitary significance of fecal coliforms in the environment. Water Pollution Control Research Series Publication No. WP-20-3. U. S. Department of the Interior, Federal Water Pollution Control Administration. 1966.
- (4) Washington Pollution Control Commission. A regulation relating to water quality standards for interstate and coastal waters of the State of Washington and a plan for implementation and enforcement of such standards. December 4, 1967.
- (5) Idaho State Department of Health. Implementation, enforcement and surveillance plan for the rules and regulations for standards of water quality for the interstate waters of Idaho. June 1967.

APPENDIX

STREAM SURVEY DATA

STREAM SURVEY DATA

PAGE 1 OF 12

STATION NAME Snake River below Clarkston, Washington

STATION NO. 543015 LAB. NOS. _____

DATES OF SURVEY July 29-30, 1969

FIELD CREW D. Bodien WEATHER Hot & Dry

G. Burns AIR TEMP _____

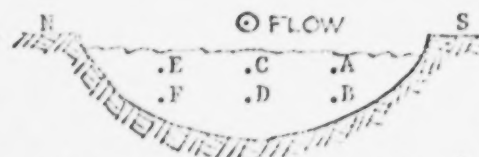
M. Crady ALK. FACTOR _____

D.O. FACTOR 1.0

pH METER No. HWC - 20070

COND. BRIDGE No. 85563

CURRENT METER No. ----



KEY TO LOCATION IN CROSS SECTION.

REMARKS A & B taken under 1st Fell

C & D taken between 2 & 3 Fell

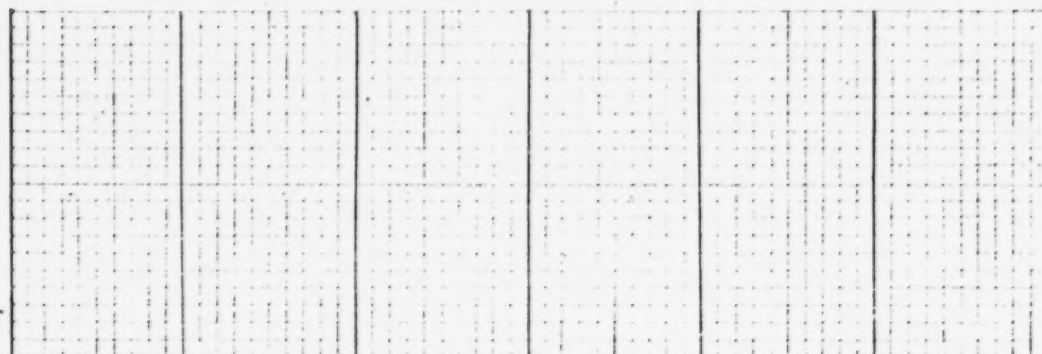
E & F taken under 4th Fell

A, C & E 1M below surface

B, D & F 15' below surface

River 17' deep at all 3 points

CHANNEL CROSS SECTION



27

Reproduced from best available copy.



STATION NO. 543016

STREAM SURVEY DATA

PAGE 2 OF 12

PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)						STATISTICS	
	A	B	C	D	E	F	MAX.	MIN. AVG.
TEMP. °C	23.8	24.0	23.4	23.8	23.2	23.0		
COND. µmho	189	193	185	189	185	182	24.0	23.0 23.5
pH	7.4	7.9	7.3	7.3	7.5	7.4	182	193 187
ALK. mg/l.							7.3	7.9 7.5
D.O. mg/l.								
TURB. #	415	430	395	397	608	393	8.8	8.7 8.8
TURB. #	1.7	1.8	0.8	1.4	1.0	1.7		
TEMP. °C	25.2	22.8	22.6	23.0	22.8	23.2	1.8	0.8 1.2
COND. µmho	193	189	193	188	186	188	25.2	22.8 23.3
pH	7.5	7.5	7.4	7.5	7.6	7.8	193	188 190
ALK. mg/l.							7.8	7.4 7.6
D.O. mg/l.								
TURB. #	209	105	181	32	267	38	9.1	9.2 9.2
TURB. #	1.7	1.7	1.6	1.3	1.3	1.4	1.7	1.3 1.5

28

TIME 1200

TIME 1400

TIME 1400

PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)							STATISTICS		
	A	B	C	D	E	F		MAX.	MIN.	AVG.
TEMP. °C	23.4	23.2	23.0	23.0	23.0	23.2		23.4	23.0	23.1
COND. µmho	194	183	186	186	184	188		194	184	188
pH	8.0	8.4	8.4	8.5	8.5	8.5		8.5	8.0	8.4
A.K. ml. VALUE										
D.O. ml. VALUE	9.7	9.7	9.7	9.7	9.7	9.7		9.7	9.7	9.7
TEMP. °F	43	37	42	208	205	198				
	1.4	1.4	1.1	0.8	1.2	0.8		1.4	0.8	1.1
TEMP. °C	23.8	23.2	22.8	22.8	23.0	23.0		23.8	22.8	23.1
COND. µmho	190	188	187	183	182	185		190	182	186
pH	8.3	7.4	7.5	7.4	7.5	7.7		8.3	7.4	7.6
A.K. ml. VALUE										
D.O. ml. VALUE	10.0	10.0	9.9	10.0	9.9	10.0		10.0	9.9	10.0
TEMP. °F	324	139	219	139	217	264				
	1.1	0.8	1.1	0.8	0.8	1.0		1.1	0.8	0.9

TIME 1600

TIME 1800

STATION NO. 543016

STREAM SURVEY DATA

PAGE 2 OF 12

PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)							STATISTICS		
	A	B	C	D	E	F		MAX.	MIN.	AVG.
TEMP °C	22.8	22.4	22.4	21.8	22.2	22.4		22.8	21.8	22.3
COND. µmho	182	182	180	180	176	172		182	172	179
pH	8.3	8.6	8.6	8.5	8.6	8.6		8.6	8.3	8.5
ALK. mg/l TITRANT ml VALUE										
DO. % TITRANT ml VALUE	9.9	10.0	9.8	9.8	9.8	9.9		10.0	9.8	9.9
TEMP. #	250	128	201	206	222	216				
	1.1	1.2	1.3	1.4	1.1	0.8		1.4	0.8	1.2
TEMP °C	21.0	21.4	21.6	21.4	21.6	21.8		21.8	21.0	21.5
COND. µmho	172	174	171	169	165	168		174	165	170
pH	8.2	8.3	8.4	8.4	8.4	8.3		8.4	8.2	8.3
ALK. mg/l TITRANT ml VALUE										
DO. % TITRANT ml VALUE	9.2	9.2	9.3	9.2	9.3	9.2		9.3	9.2	9.2
TEMP. #	207	202	212	195	217	203				
	0.8	0.8	0.8	0.8	0.8	0.6		0.8	0.6	0.8

TIME 2000

TIME 2200

STREAM SURVEY DATA

PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)							STATISTICS	
	A	B	C	D	E	F		MAX	MIN. AVG.
TEMP. °C	20.6	20.4	20.4	20.6	20.6	21.0		21.0	20.4 20.6
COND. µmho	168	164	165	167	165	163		168	163 165
pH	7.6	8.1	8.3	8.0	8.1	8.1		8.1	7.6 8.0
ALK. mg/l									
TITRANT ml									
DO mg/l	8.3	8.5	8.5	8.5	8.5	8.5		8.5	8.3 8.5
TURB. #	208	213	218	193	204	202			
TEMP. °C	0.7	0.7	0.6	1.0	1.0	0.7		1.0	0.6 0.8
COND. µmho	20.2	19.6	19.8	19.3	19.8	20.2		20.2	19.6 19.8
pH	164	148	164	167	168	164		168	163 164
ALK. mg/l	8.0	8.0	7.9	7.9	7.9	7.9		8.0	7.9 8.0
TITRANT ml									
DO mg/l	8.4	8.2	8.0	8.3	8.4	8.2		8.4	8.0 8.3
TURB. #	214	193	224	205	210	215			
TEMP. °C	0.6	0.8	0.8	0.7	1.0	0.7		1.0	0.6 0.8

TIME 2400

TIME 0200

TIME 0200

STATION NO. 543016

STREAM SURVEY DATA

PAGE 6 OF 12

PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)							STATISTICS	
	A	B	C	D	E	F		MAX.	MIN. AVG.
TEMP. °C	19.6	19.6	19.4	19.8	19.8	19.8		19.8	19.4 19.7
COND. µmho	137	159	160	161	158	158		161	157 159
pH	7.9	7.9	7.8	7.8	7.9	7.8		7.9	7.8 7.9
ALK. meq/l									
D.O. mg/l									
TURB. #	8.0	8.0	8.1	8.0	8.0	8.0		8.1	8.0 8.0
TEMP. °C	18.6	19.0	18.8	19.2	19.2	19.6		19.6	18.6 19.1
COND. µmho	153	159	159	160	159	159		160	153 158
pH	7.8	7.8	7.7	7.7	7.8	7.7		7.8	7.7 7.8
ALK. meq/l									
D.O. mg/l									
TURB. #	92	4	26	41	56	91		7.9	7.7 7.8
	1.2	0.7	0.7	0.4	0.8	0.8		1.2	0.4 0.8

STATION NO. 543016

STREAM SURVEY DATA

PAGE 7 OF 12

PARAMETER	LOCATION, IN CROSS SECTION (SEE KEY ON PAGE 1)							STATISTICS	
	A	B	C	D	E	F		MAX.	MIN. AVG.
TEMP. °C	19.4	19.6	19.5	19.6	19.6	19.4		19.6	19.4 19.5
COND. µmho	172	154	162	164	164	160		172	154 163
pH	7.5	7.7	7.8	7.8	7.8	7.8		7.8	7.5 7.7
ALK. mg/l									
D.O. mg/l	8.0	7.9	7.9	7.9	8.0	7.9		8.0	7.9 7.9
TURB. #	3	25	38	54	90	1			
	0.8	0.7	0.4	0.6	0.4	0.4		0.8	0.4 0.5
TEMP. °C	21.2	20.8	20.8	21.2	21.0	21.0		21.2	20.8 21.0
COND. µmho	182	179	177	176	172	175		182	172 177
pH	7.5	7.7	7.6	7.7	7.6	7.8		7.8	7.5 7.7
ALK. mg/l	8.2	8.2	8.2	8.2	8.2	8.2		8.2	8.2 8.2
D.O. mg/l	8.2	8.2	8.2	8.2	8.2	8.2		8.2	8.2 8.2
TURB. #	21	38	50	62	1	6			
	0.5	0.7	0.6	0.8	0.7	0.5		0.8	0.5 0.6

PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE)						STATISTICS	
	1	2	3	4	5	6	MAX.	MIN. AVG.
TEMP. °C								
COND. µmho	217	244	190	235	250	249		
pH	8.5	8.7	7.5	8.5	8.4	8.8		
ALK. mg/L								
D.O. mg/L	9.6	9.6	9.2	10.4	10.6	10.4		
TURB. #	216	550	706	10	4	695		
TEMP. °C	0.6	0.5	0.3	0.5	0.7	0.7		
COND. µmho								
pH								
ALK. mg/L								
D.O. mg/L								

STREAM SURVEY DATA

PAGE 9 OF 12

TOTAL COLIFORMS

STATION NO. 543016

TIME	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)												AVERAGE NUMBER / 100 ml.
	A				B				C				
	50 ml.	10 ml.	1 ml.	number / 100 ml.	50 ml.	10 ml.	1 ml.	number / 100 ml.	50 ml.	10 ml.	1 ml.	number / 100 ml.	
1200	28			56		14		140			09	900	
1400			13	1300			07	700		18		180	
1600		42		420		22		220	12			24	
1800	09			18			10	1000		36		360	
2000			33	3300			24	2400			10	1000	
2200			66	6600			25	2500			17	1700	
2400			05	500			35	3500			64	6400	
0200		17		170		11		110			14	1400	
0400		25		250			38	3800			30	3000	
0600			22	2200			56	5600			38	3800	
0800			22	2200			22	2200			30	3000	
1000			22	2200			22	2200			27	2700	
AVERAGE				1601				2031				2039	

STREAM SURVEY DATA

PAGE 10 OF 12

TOTAL COLIFORMS

STATION NO. 543016

TIME	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)												AVERAGE NUMBER / 100 ml. FOR A-F
	D				E				F				
	50 ml.	10 ml.	1 ml.	number / 100 ml.	50 ml.	10 ml.	1 ml.	number / 100 ml.	50 ml.	10 ml.	1 ml.	number / 100 ml.	
1200			17	1700			8	800			10	1000	766
1400		10		100		16		60		117		1170	583
1600		07		700	12			24		61		610	333
1800			20	2000		20		200		50		500	680
2000			30	3000			33	3300			43	4200	2857
2200			63	6300		21		210			22	2200	3252
2400			13	1300			49	4900				-	3320
0200			19	1900			07	700			51	5100	1564
0400			15	1500		07		70			29	2900	1920
0600			37	3700			30	3000			50	5000	3884
0800			35	3500			32	3200			20	2000	2684
1000			33	3300			23	2300			16	1600	2384
AVERAGE				2417				1564				2389	2020

STREAM SURVEY DATA

PAGE 11 OF 12

FECAL COLIFORMS

STATION NO. 543016

TIME	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)												AVERAGE TOTAL /100 ft.	
	A				B				C					
	50 ft.	10 ft.	1 ft.	number /100 ft.	50 ft.	10 ft.	1 ft.	number /100 ft.	50 ft.	10 ft.	1 ft.	number /100 ft.		
1200	0		-		0			-		0			-	
1400	1		2		3			6		0			-	
1600	0		-		0			-		0			-	
1800	0		-		2			4		0			-	
2000	2		4		0			-		0			-	
2200	5		10		14			28		8			16	
2400	45		90		61			122		76			152	
0200	54		108		29			58		22			44	
0400	42		84					110		33			66	
0600	71		142		47			94			15		150	
0800	16		32		20			40		18			36	
1000	0		-		4			8		3			6	
AVERAGE			39					39					39	

STREAM SURVEY DATA

PAGE 12 OF 12

LEGAL CONFORMS

STATION NO. 543016

TIME	LOCATION IN CROSS SECTION: (SEE KEY ON PAGE 1)												AVERAGE / 100 ml. A-F
	D				E				F				
	50 ft.	10 ft.	1 ft.	100 ft.	50 ft.	10 ft.	1 ft.	100 ft.	50 ft.	10 ft.	1 ft.	100 ft.	
1200	1			2	0			-	1			2	1
1400	1			2	0			-	0			-	2
1600	0			-	0			-	0			-	-
1800	5			10	1			2	0			-	3
2000	0			-	1			2	0			-	1
2200	12			24	12			24	50			100	19
2400	80			160				260				-	157
0200	18			36	25			50	16			32	55
0400	22			44	100			200	127			254	126
0600		22		220				300		27		270	196
0800	41			82	42			84	41			82	59
1000	6			12	0			-	3			6	6
AVERAGE				49				77				62	52